iFADO Project: contribution to the implementation of the MSFD in the Atlantic Area through modelling and in situ monitoring

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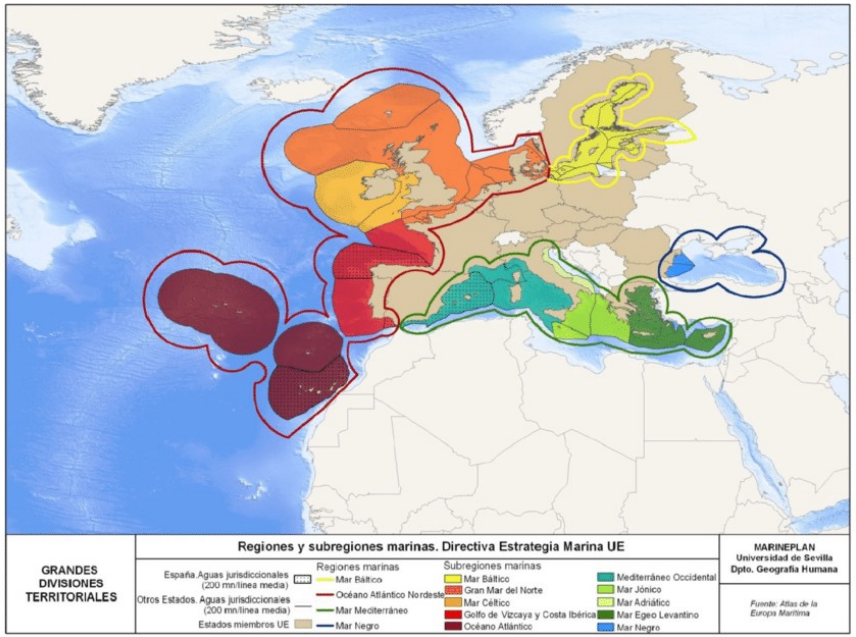
IEO A Coruña

Introduction: MSFD

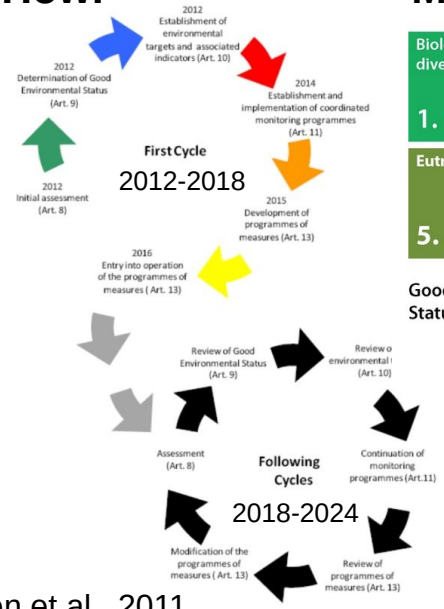


Source: Suarez-de Vivero JL, 2011.

Aim: protect the marine environment across Europe.

Target: "Good Environmental Status" which must be achieved in EU marine waters by 2020.

How:



Source: Claussen et al., 2011

MSFD Descriptors:

Good Environmental Status

Criteria

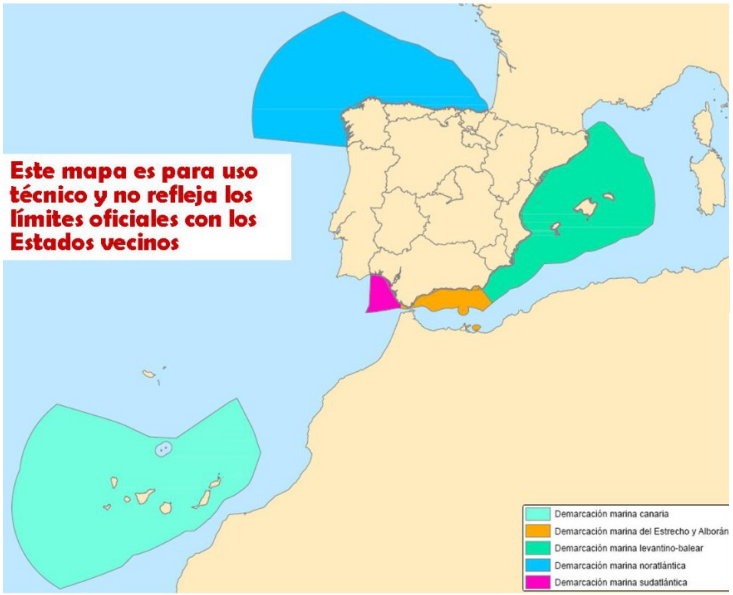
D5C1:nutrient concentrations are not at levels that indicate adverse eutrophication effects

Indicators

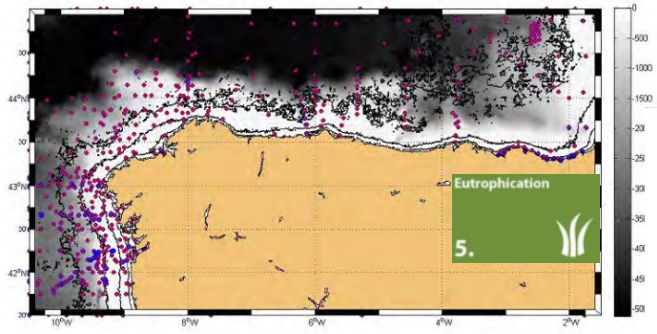
Winter concentration of nutrients

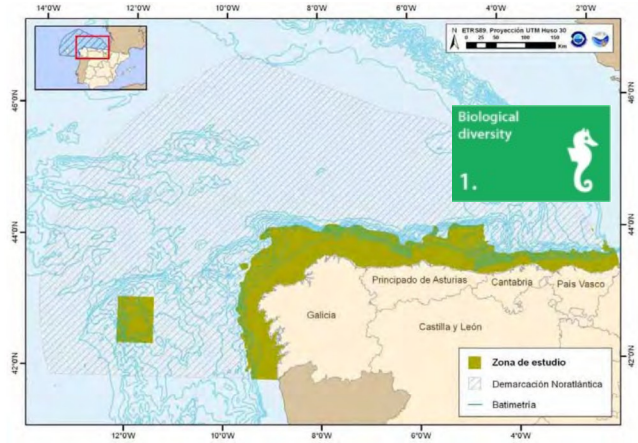
The MSFD was adopted in June 2008 and is the environmental component of Europe's Integrated Maritime Policy.

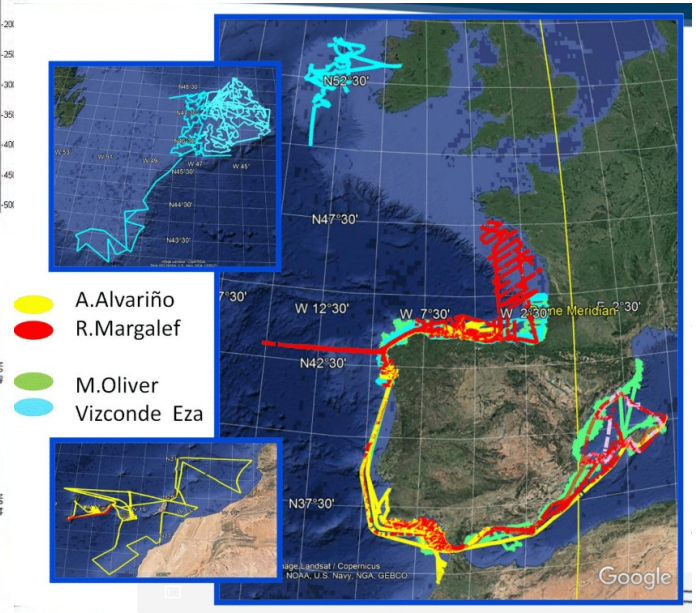
Introduction to MSFD



Very few observations in offshore areas



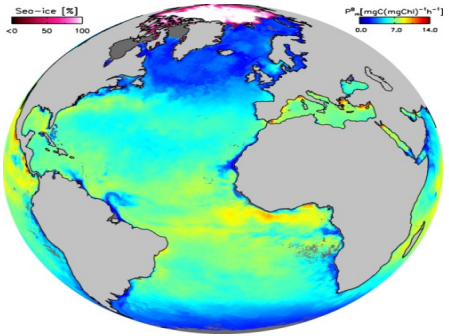


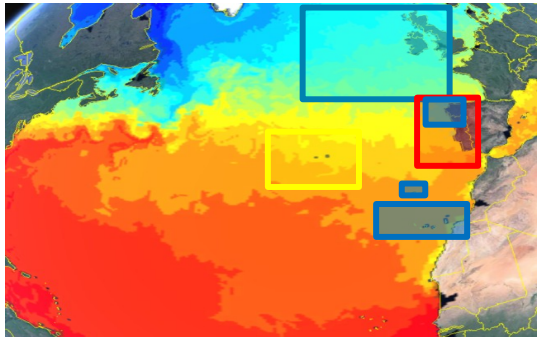


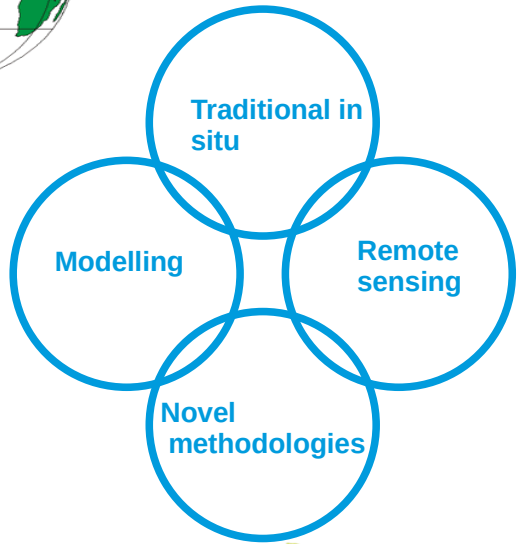
From Elena Tel (IEO)

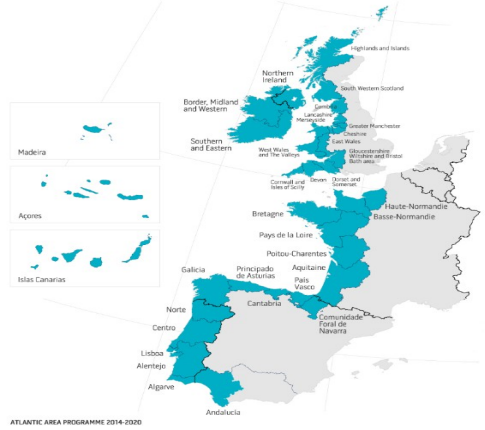
The iFADO Project

Innovation in the framework of the Atlantic Deep Ocean









Assisting the implementation of the MSFD especially in offshore areas

In situ monitoring (WP4)

- Sampling and analytical methods harmonization: common practices in the Atlantic Area
- Development of Standard Operating Protocols (SOPs)

SOP8. Net samples processing and ZooScan imaging analysis

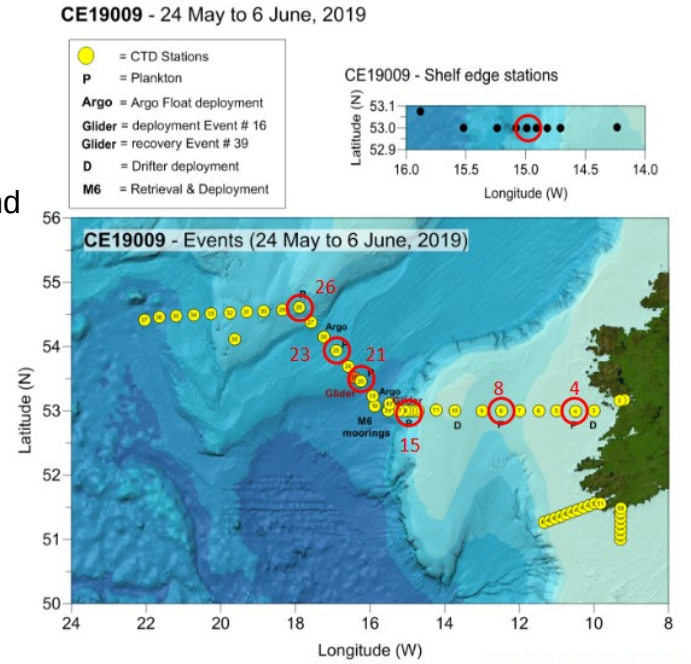
1. Scope and field of application

This SOP aims to provide guidelines on the imaging analysis of mesozooplankton samples (SOP P7) with ZooScan.

Zooplankton includes an array of macro- and microscopic animals. Herbivorous zooplankton feed on phytoplankton (primary producers), and it is in turn eaten by carnivorous zooplankton (primary consumers) and animals of higher trophic levels (secondary consumers), including zooplankton members. Consequently, zooplankton is responsible for critical roles at the level of trophic web functioning, ecosystem productivity, as well

SOP

SOP1: CTD deployment and data acquisition
SOP2: determination of pigments concentration by HPLC
SOP3: Flow-cytometry
SOP4: inverse filtration for phytoplankton biomass concentration
SOP5: FlowCAM(R)
SOP6: Ecotaxa
SOP7: Plankton nets
SOP8: ZooScan



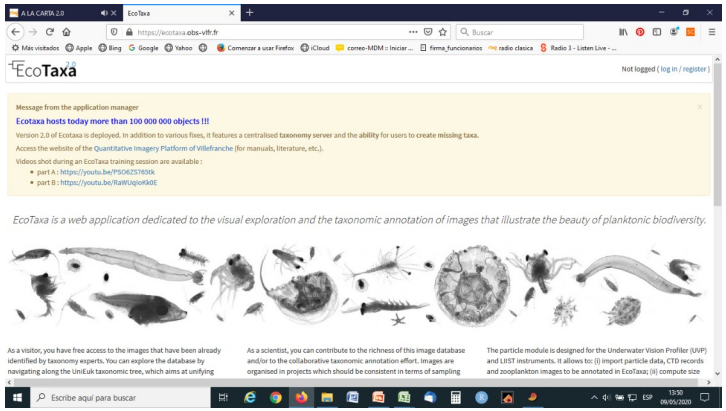
Ireland

In situ monitoring (WP4)

Semi-automatic methods for the characterization of plankton communities

•Sampling: vertical hauls (0-200m) of bongo-type plankton net (50 cm diameter, 200µm mesh). Preservation in formaldehyde (4% final conc.)

• Analysis:
  - Manual: microscope identification of taxa (A, TA)
  - Semiautomatic: scanning and image analysis:
    - ZooImage (A, B)
    - ZooProcess / ECOTAXA (A, TA, B)



https://ecotaxa.obs-vlfr.fr/

https://www.sciviews.org/zooimage/

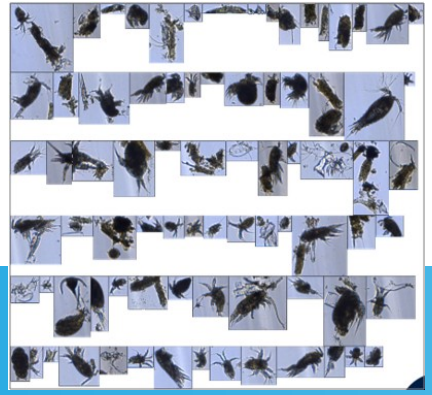
A: total abundance

B: total biomass

TA: taxa abundance

Manual analysis

- detailed taxa identification
- reference method
- long time (days)
- high taxonomic expertise
- partial sample destruction

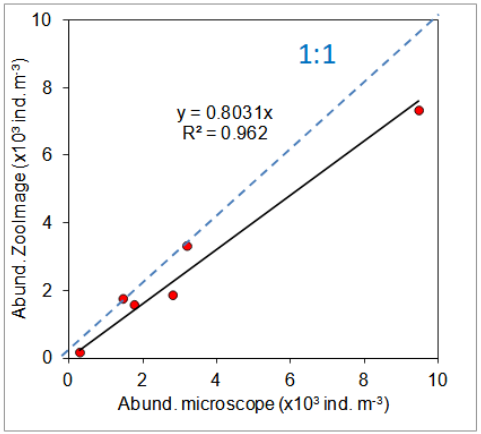


Semiautomatic analysis

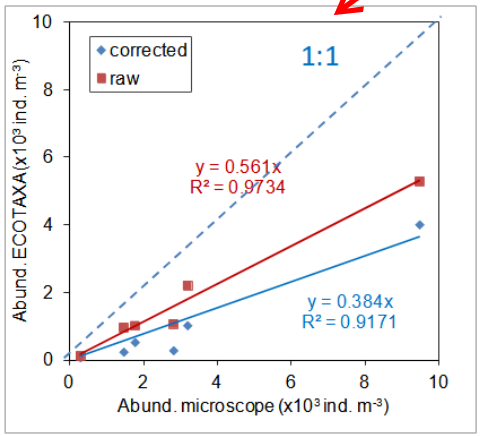
- less detailed taxa identification
- several methods
- short time (hours)
- low taxonomic expertise
- no sample destruction

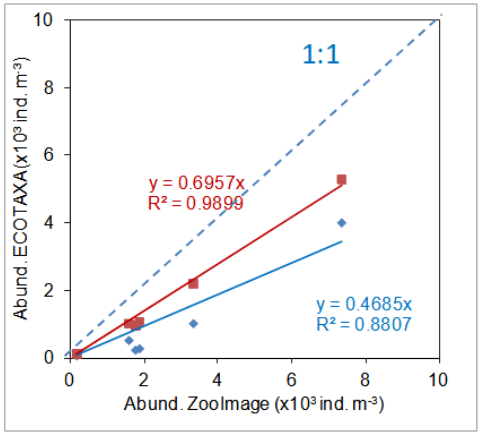
Semi-automatic methods for the characterization of plankton communities

TA ZooImage = 80.3% TA Microscope

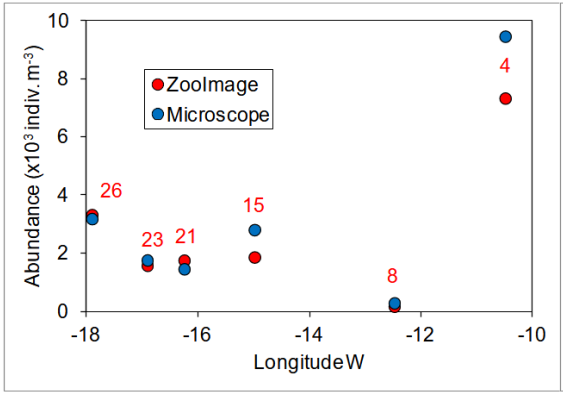


TA ECOTAXA = 46.9-69.6% TA Microscope

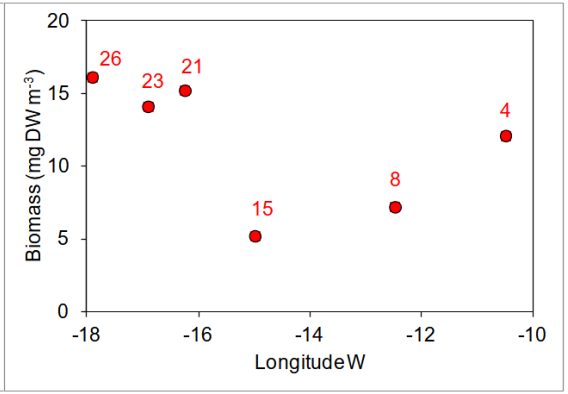




abundance

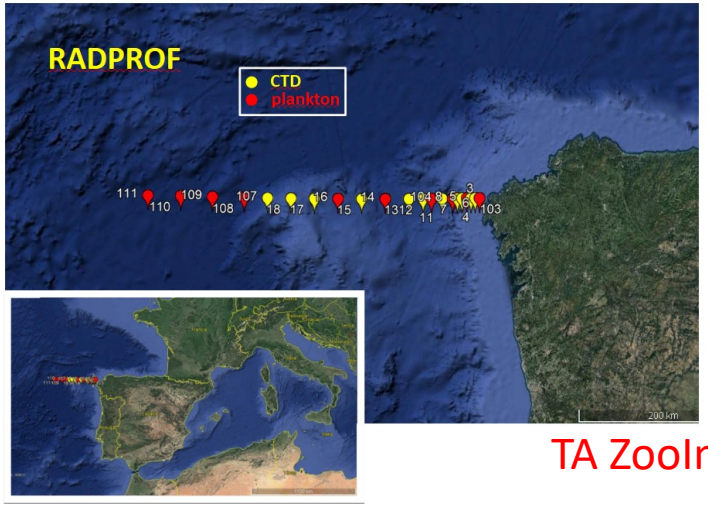


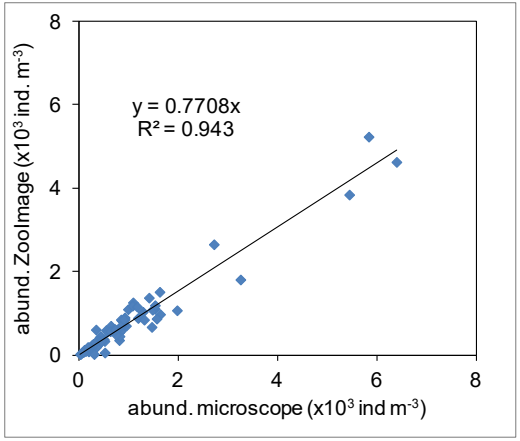
biomass

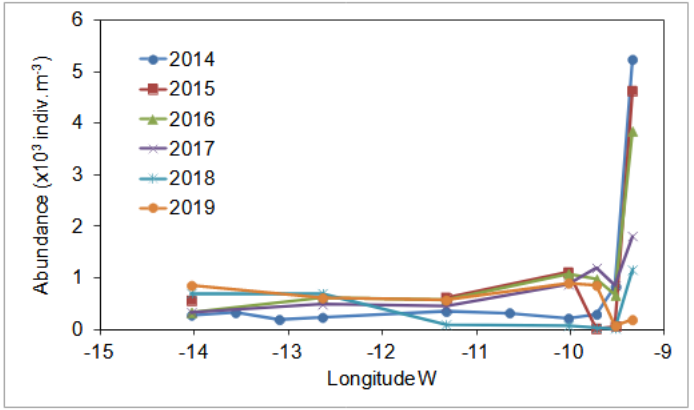


- semi-automated method allow for estimations of total abundance (A) and biomass (B) comparable to manual methods
- **ZooImage** performs better than ZooProces/ECOTAXA for A and B
- **ZooProcess/ECOTAXA** allow for classification of samples comparable to manual methods
- **Manual methods** still required for detailed taxa identification and quantification (TA)

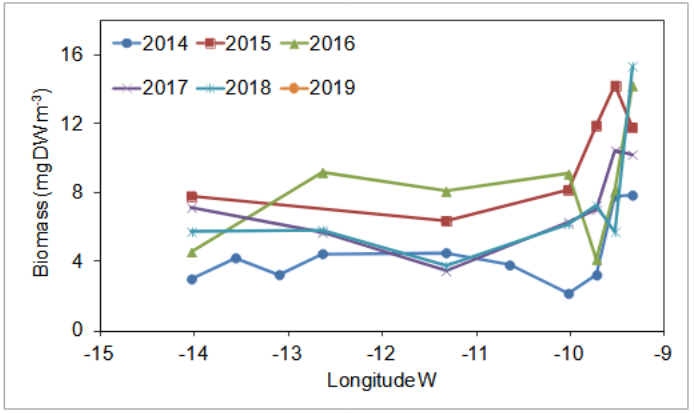
Semi-automatic methods for the characterization of plankton communities: RADPROF

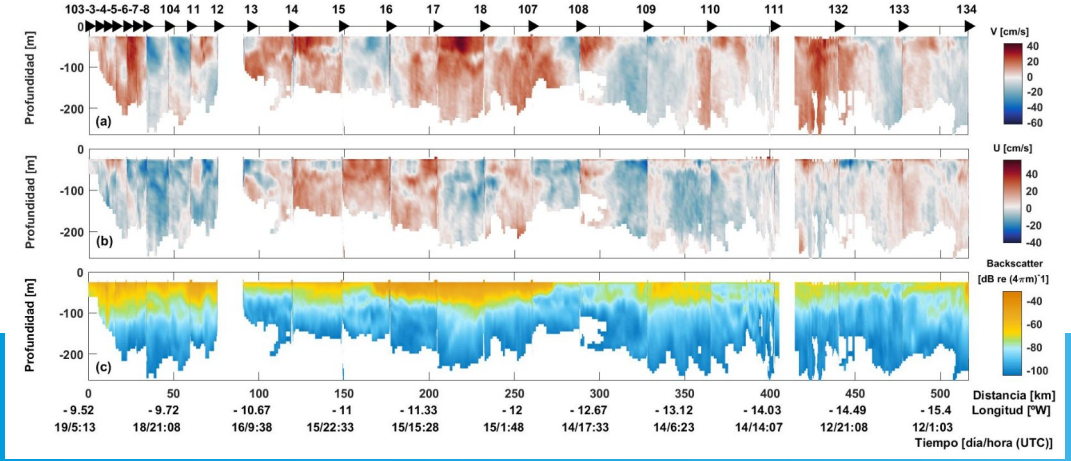






TA ZooImage = 77.1% TA Microscope





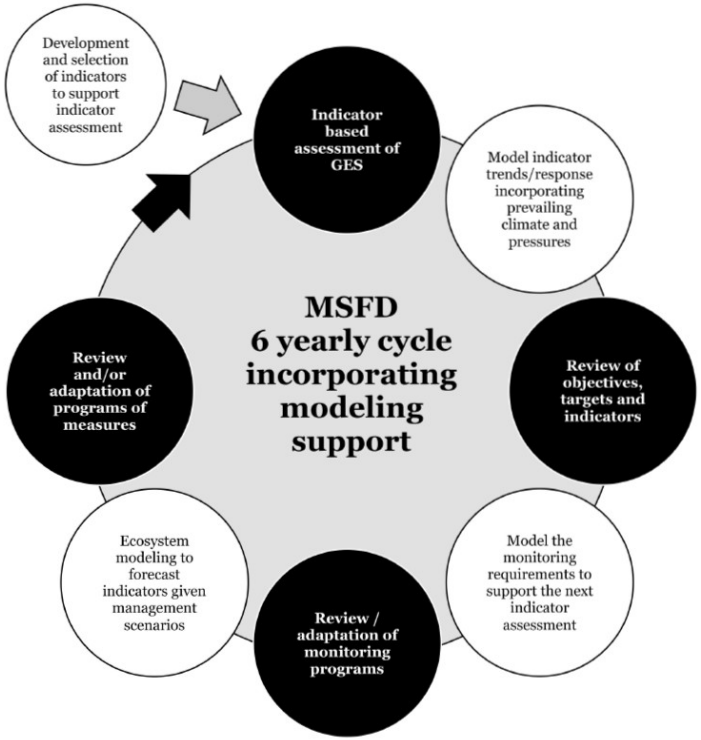
ADCP

Numerical models

Numerical models are key for the implementation of the MSFD:

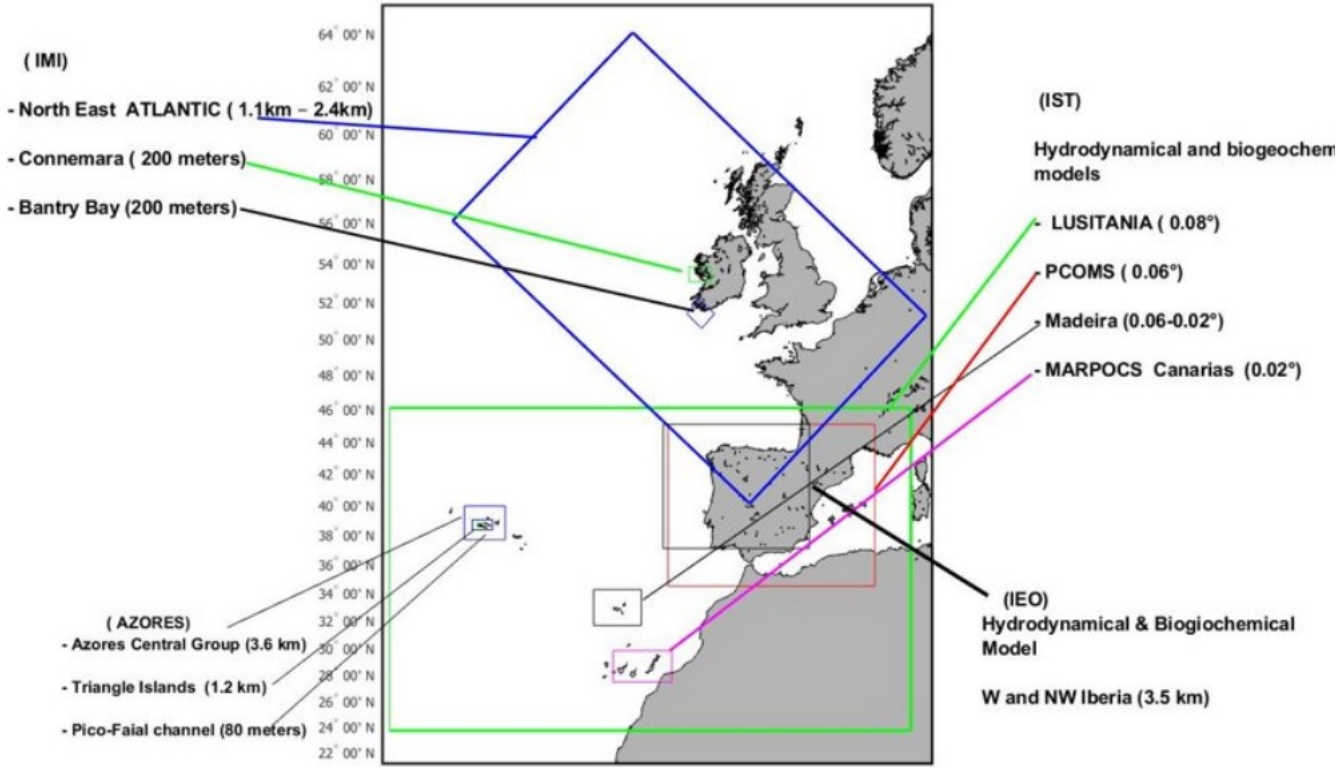
- They provide information on indicators/potential indicators and trends
- Help exploring potential impacts/management scenarios through projections

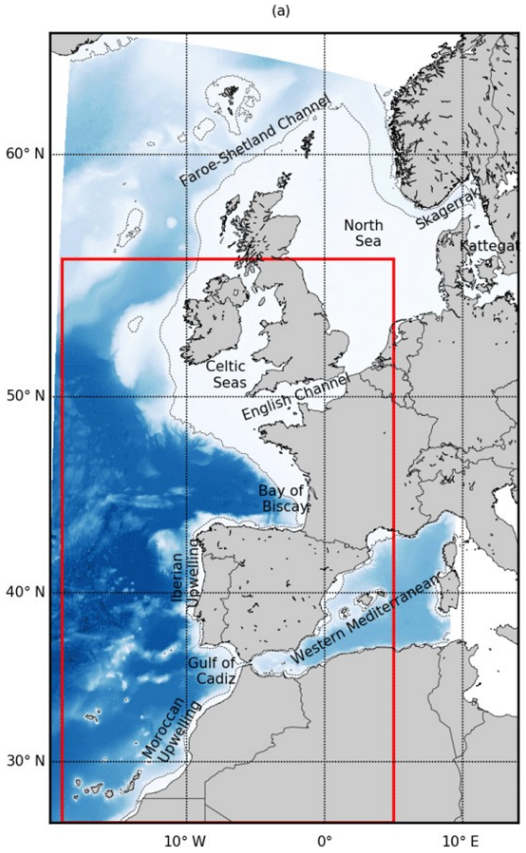
- Help to disentangle the natural variability from the anthropogenic induced variability
- Set the baseline for the “prevailing conditions” relative to which the GES is defined
- Help in the definition of the “ecologically relevant assessment areas” to assess the GES.



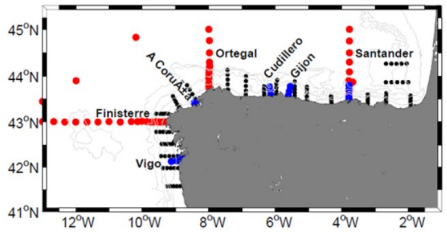
Lynam et al., 2016

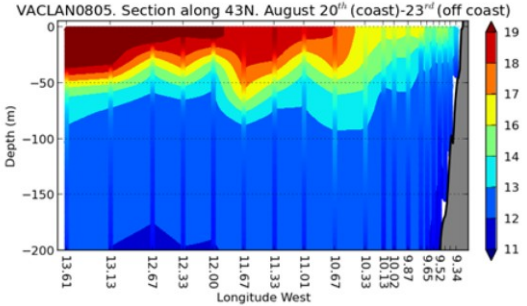
The iFADO model configurations

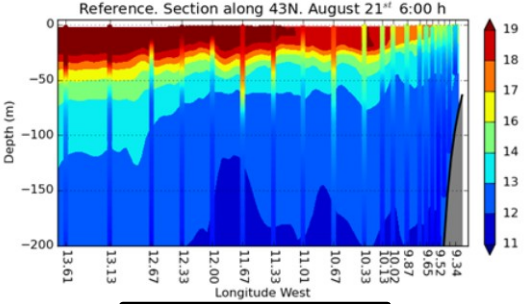




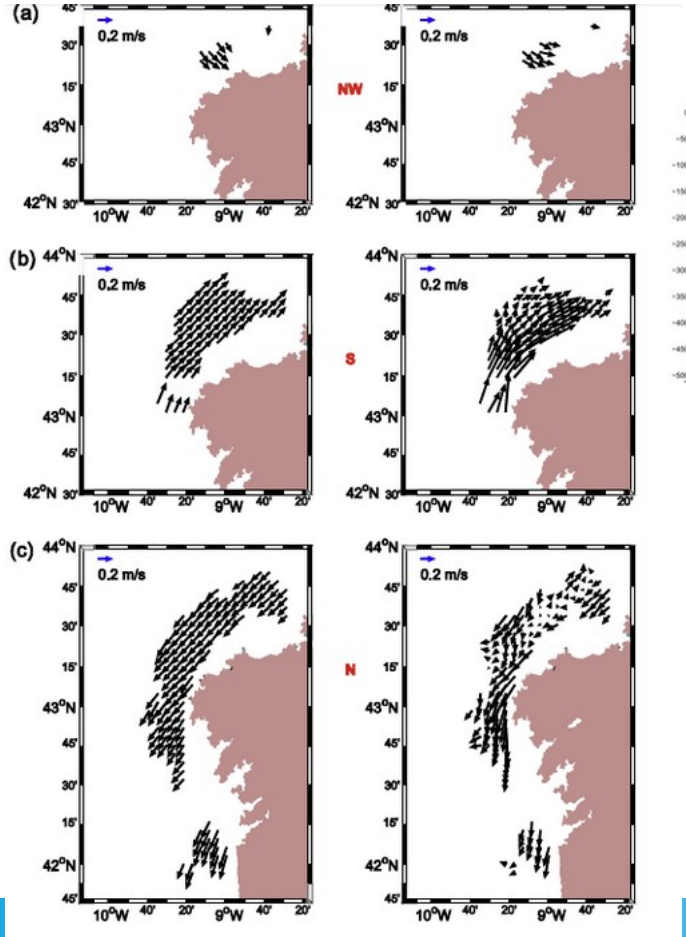
Model validation





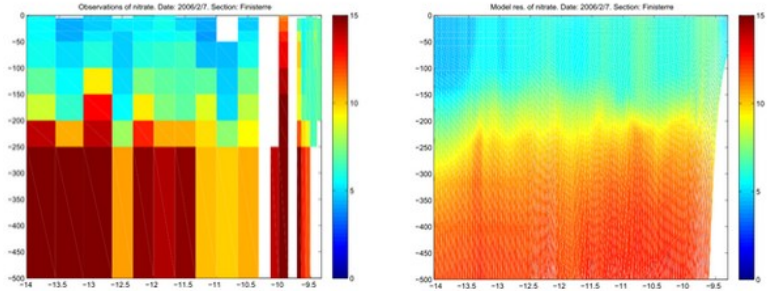


Temperature

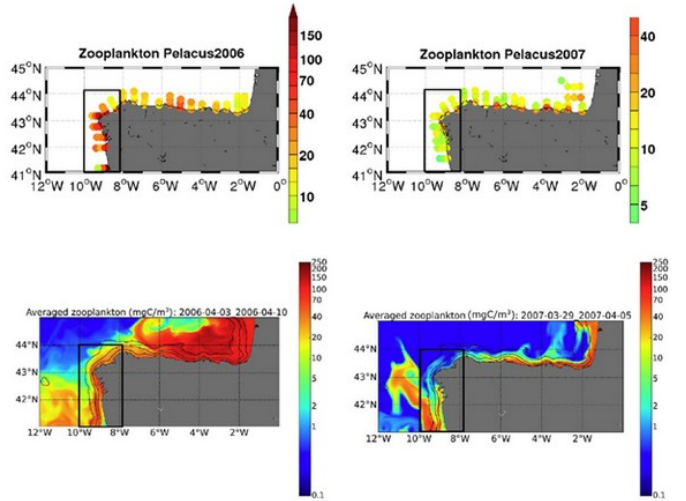


Currents

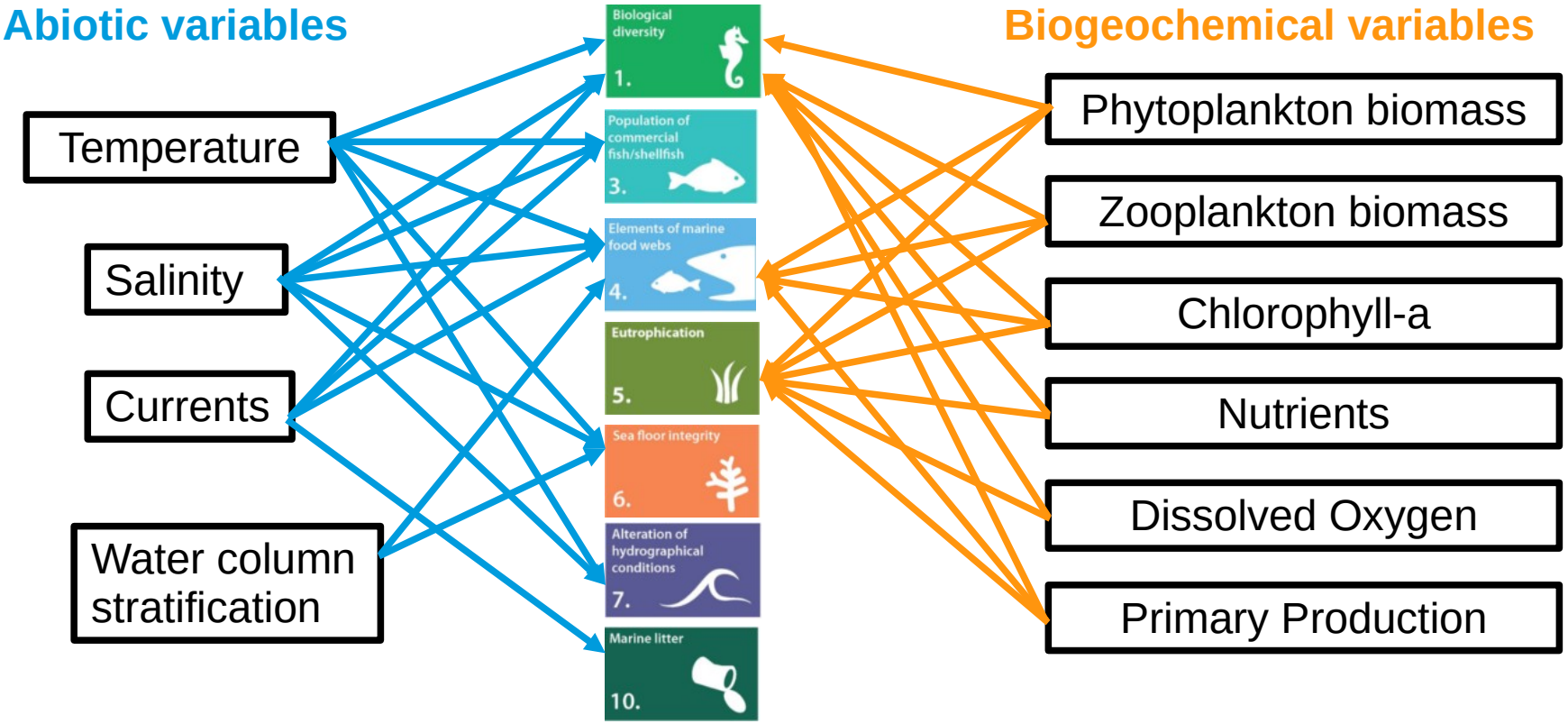
Nitrate (Radprof Feb2006)



Zooplankton (Pelacus 2006 and 2007)



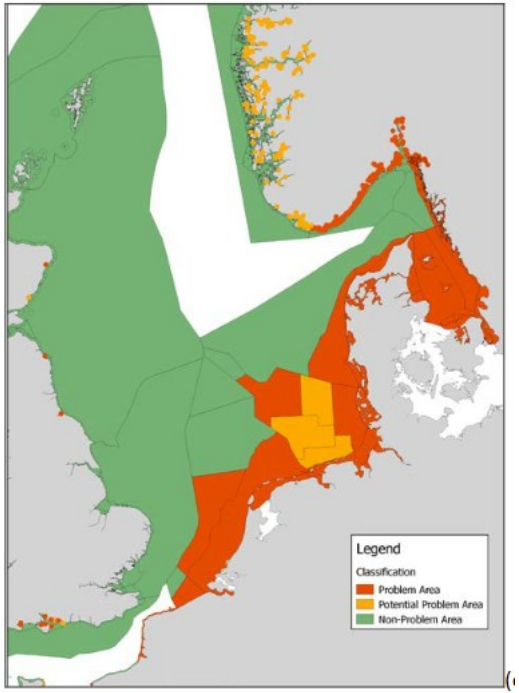
Contribution of iFADO models to MSFD Descriptors

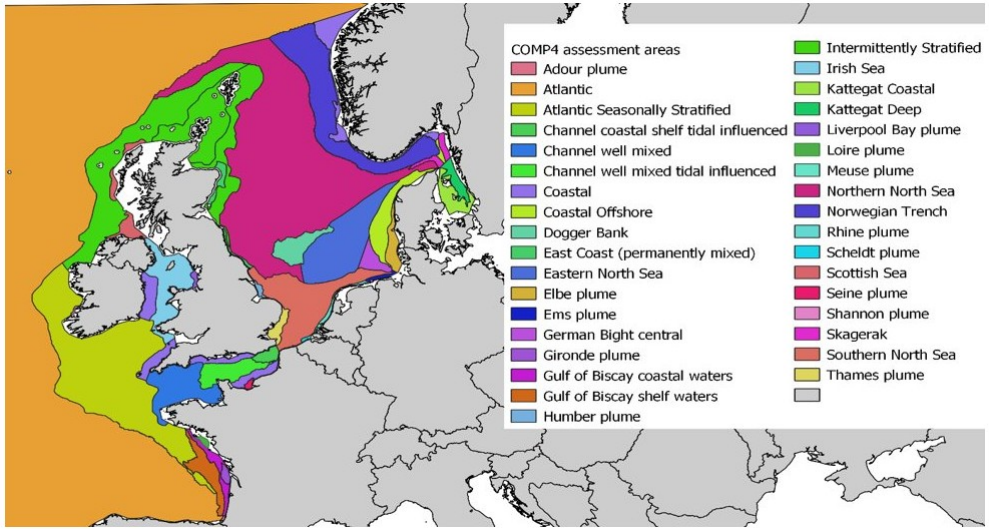


Model derived indicators

Others: Zooplankton phytoplankton mass ratio, Diatoms/nanophytoplankton index, Seasonal succession of dominating phytoplankton groups, ratio mesozooplankton/microzooplankton, bloom related indices

Contribution of iFADO models to MSFD/OSPAR assessment units





Use of hydrodynamic models together with satellite chlorophyll

CONCLUSIONS

- IFADO is an ongoing project 

- We plan to provide results on Model Derived Indicators for one MSFD assessment cycle with the iFADO models. We are especially interested in zooplankton
  - Comparison/combination with observations
- Synergies with OSPAR Eutrophication assessments: use of our models to generate sensible and ecologically relevant assessment areas